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Computer-Aided Design in Textiles, Building and Cartography

We publish below three articles whose diversity lends support to the observation that CAD is by definition so open-ended that it defies definition. Two of the articles describe the application of the computer to the particular fields covered by specialist units at the Royal College of Art; the other covers one facet of the wide-ranging work of DTI's CAD Centre at Cambridge. The CADC, incidentally, has recently set up a London Sub-Centre at premises leased from the Royal College of Art, and reference to this is also made below.

CAD and the Building Industry

by P. D. Lever,
Consultant, Computer-Aided Design Centre

THE Department of Trade and Industry's Computer-Aided Design Centre, Cambridge, was set up some three years ago to assist industry in exploiting CAD to maximum advantage. Specifically its objectives are:

(i) to provide a national centre equipped with the computer-system facilities necessary for promoting the use of CAD and helping industry to employ CAD techniques to better effect;

(ii) to make available specialised remote-access computer facilities enabling firms to develop and use computer-aided design techniques in their own way and under their own control;

(iii) to create a proving ground for, and hence to establish the economic benefits of, equipment and methods used in computer-aided design;

(iv) to avoid unnecessary duplication and dissipation of development effort by ensuring that commonly applicable software developments are employed to maximum effect in as wide a range of fields as possible.

The Centre is operated by ICL Dataskil under a contract which ensures the availability of highly qualified consultants and programming staff. One area of computer-aided design for which the Centre is now firmly established as a national focus of activity is the building industry. This article reviews the role it is playing in this particular field.

CADC's facilities

The system and services offered by the Computer-Aided Design Centre have attracted considerable interest from the building industry and its professions (we are talking here of the 'building' rather than the 'architectural' industry, because it is in a multi-disciplinary environment that most of the benefits of computer-aided design can be derived). Much of the interest has concentrated on the range of remote-access terminals that can be connected via ordinary telephone links to the central computers at Cambridge. In addition to simple teletypes, these include low-cost graphics displays, plotters, digitisers and satellite computers driving interactive display units with full light-pen facilities. The equipment is backed up with comprehensive packages of program tools, or 'software', especially in the fields of graphics and interactive design, which enable drastic reductions to be made in program-development costs and time-scales.

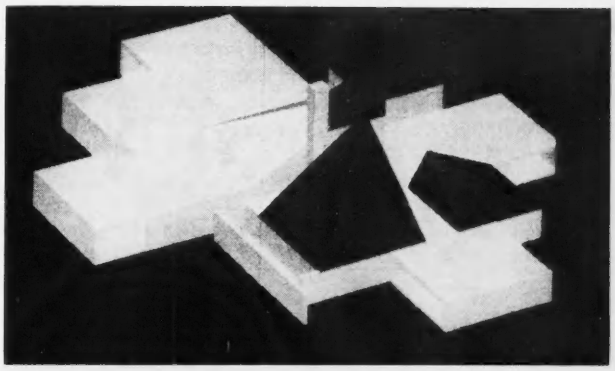

Figure 1. Using an appropriate program, perspectives of a building from any desired viewing point can be produced on an interactive display, once the digital description of the building has been fed into the computer. Alterations can then be made to the design, and the visual effect of these alterations will be revealed on the next output view of the building. The view of the Llyncoed Crematorium shown here is an example of the level of sophistication which can be achieved with shaded pictures.

These software tools are constantly being developed: the view of the Llyncoed Crematorium, North Wales, in Figure 1, is an example of the level of sophistication which can be achieved. The dimensions were taken from rough sketches, and the data were then input to the computer. Using a program which produces perspectives in the form of shaded surfaces*, the crematorium can be viewed on an interactive display from

* Acknowledgements to M. E. and R. G. Newell and T. Sancha.

any required position. The building-description input took less than one man-day to prepare and the computer cost was approximately 50p per view. This facility could be extremely useful to the architect at the early stages of design, when the proposed building appearance and its relation to existing neighbouring buildings need to be studied. In some more recent work the building perspective can be accurately superimposed on a photograph of the landscape to give an exact impression of the proposed building in its surroundings.

Computer-aided building

Since the war much progress has been made in the design and production of buildings using 'system building' or co-ordinated building methods, and it is probably reasonable to say that much of the developed world regards the United Kingdom as having model experience in this area. It has long been realised that the advent of computers could radically affect the task of design and construction of buildings, particularly where these use co-ordinated building methods. Several fruitful projects have already been established to develop data-processing systems for the design of buildings where co-ordinated building methods have been adopted. The term 'computer-aided building' has been coined for such systems.

Generally, computer-aided building is concerned with multi-disciplinary design systems, embracing the whole process from building conception to construction, for particular building types. For example, the Department of Health and Social Security are developing a very large system of design aids for architects, hospital planners and engineers, for use in conjunction with a new concept for modular hospital design. These aids can be divided into two main groups, both concerned with the selection and manipulation of project data from a general data base of hospital information. The first deals with the manual and automatic assemblies of hospital development plans and their evaluation, the second with the processing of such production documents as working drawings and schedules. The software is currently being developed at the Computer-Aided Design Centre via a comprehensive configuration of terminal equipment installed at the Department of Health and Social Security, London, for remote-access work.

Another integrated computer system is the Department of the Environment's CEDAR project for design of a range of steel-framed buildings. This system is being developed using various remote-access terminals at the Computer-Aided Design Centre's London Terminal Centre, which has recently been opened to provide London users with better access to computer-aided design facilities.

The Centre has also been involved in consultations on the feasibility of computer-aided building for various local authority system-building consortia, particularly in the school-building field.

Design Office Consortium

The Computer-Aided Design Centre's policy is to couple out the experience and value of its involvement with major and pace-setting projects for the benefit of the smaller firms and design offices. With this in mind, the Centre held a symposium early in 1971 to discuss ways in which individual architect practices could be helped. As a direct result of this symposium, the Design Office Consortium has been formed, with a membership of architects, quantity surveyors, contractors and other professionals involved in building. Its main aim is to develop a library of programs specified by its members in those areas not well served at present, and which would then be offered to members at economic rates. A secondary aim is for members to gain a gradual acquaintance in running computer programs, and a full range of education, information and advisory services is therefore also provided in parallel. In addition, the establishment of CADC regional terminal centres like the one in London will provide a relatively easy and low-cost introduction to 'hands-on' use of different types of terminal before a member commits itself to installing a terminal in its own office.

The approach required

There is no doubt that the computer will change not only design methods but also the nature and association of the professions in the building industry. But all too often the wrong approach is chosen. For instance, graphics input and output is impressive, but involves expensive terminal equipment; and there is often a temptation to use graphics when simple teletype input and output is quite adequate. This approach results in the computer's being regarded as an expensive toy, and there is often consequently a reluctance to make use of what is probably the most important tool of the century. The teletype terminal provides access to exactly the same powerful computing facilities and, in combination with simple plotters, or special techniques on the line printer, can provide all the facilities many architects and engineers need at the present time.

The computer and man are employed most effectively when their activities are complementary. The policy of partnership, with man in control, using his expertise to explore and reach a solution, is one that the Centre has firmly adopted. It is in the development of an interactive system, and the application of the computer as an aid to the designer and as a means of integrated design and manufacture, that the Centre has gained a unique knowledge and experience. The value of this approach, with its significant saving in time and cost, has been well recognised by the building industry, and the Computer-Aided Design Centre is now being used for most of the major software developments in this field within the United Kingdom.

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CADC's New Sub-Centre

In collaboration with the Royal College of Art, DTI's CAD Centre has set up in Kensington a sub-centre—open 09.00-22.00 hours Monday to Friday—with permanent lines to its computer system at Cambridge. It houses terminal equipment, and a communications multiplexor serving the centre itself and providing local-call facilities for users having their own terminals.

Telephone charges: Any user in the London telephone area having a teletype or graphic-display terminal can dial the CAD Centre in Cambridge for the cost of a local call. Both Datel 200 and Datel 600 services are available.

Equipment: Terminal Centre users can take advantage, at hourly rates, of the following equipment—

- five teletype consoles;
- two storage-tube graphic-display terminals;
- a MECS 905 satellite computer and 928 graphic-display unit with light pen and function keyboard;
- a 30-inch incremental plotter.

All the graphic devices are backed by the full range of graphics software of the CAD Centre system, and hence provide the user with the means for running graphics programs and displaying two- and three-dimensional pictures in a variety of forms.

More information

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The Controller, the Computer-Aided Design Sub-Centre, Gore Cottage, Jay Mews, Kensington, London SW7. Tel: 01-584 3768.

CAD Centre Booklet

ALL the CAD facilities and services offered by the CAD Centre are described in a 70-page illustrated booklet which the Centre has produced for the information of interested firms. **Copies are available, free of charge, from the Computer-Aided Design Centre, Madingley Road, Cambridge CB3 0HB. Tel: 0223-63125.**

Editing and Storage of Map Detail by Computer

by A. N. Barrett,
Experimental Cartography Unit, Royal College of Art

Figure 1. A cartographer using a 'hedgehog' to digitise a map at the Royal College of Art's Experimental Cartography Unit.

THE Experimental Cartography Unit (ECU) was first set up in Oxford in 1967—the Unit is funded by the National Environment Research Council, and is under the direction of Mr. David Bickmore—to demonstrate the feasibility of an automated system in cartography. Such an automated system may be described by four aspects—the data, methods of data encoding, computer processing and display. In the cartographic sense, this means the digitising of an existing map, processing the resultant data on a computer and then deriving from this data another map, which could be drawn either on to an automatic drafting machine or a cathode-ray tube. In general, the final map consists of an amalgamation of maps plotted at a reduced scale.

In 1970 the ECU moved to the Royal College of Art, South Kensington, for the purpose of further development of automated systems in cartography and to demonstrate the application of such systems to handling different sources of cartographic data.

Hardware configuration

Currently the Unit has two D-mac digitising tables which have a resolution of 0.01 mm. The D-mac is a flat table on which the operator can record a stream of digitised co-ordinates by following the course of relevant lines on the input map with a device called a *hedgehog* The hedgehog is, in principle, like a D-mac pencil follower, but has the additional flexibility of allowing the operator to enter digits or characters of a certain type at the time of digitising via a set of keys on its base (see Figure 1). Output is recorded on an IBM compatible magnetic tape.

The Unit's processing and computing equipment consists of a PDP9 and a PD15 digital computer. The PDP9 is used basically by the applications section for production work, and supports 16K core storage of 18 bit words, as well as a fixed-head disc, an interactive CRT, an IBM tape deck and a teletype. The PDP15 is used for program development, and supports 24K core storage of 18 bit words, a fixed-head disc, an interactive CRT, an IBM deck tape, a line printer and a teletype. A third tape deck is shared between the two computers. The Unit will shortly acquire a 10-million-word movable disc pack linked to the PDP15.

The output or drafting device—the so called *Geagraph*, which is basically a flat-bed plotter—has a resolution of 0.02 mm, and is controlled by the PDP9. The Geagraph provides the output either in the form of scribing or (via a light spot projector) in the form of plots on photographic film. It enables single, double or pecked lines of several thicknesses, and a variety of standard symbols, to be plotted under the control of a program running on the PDP9.

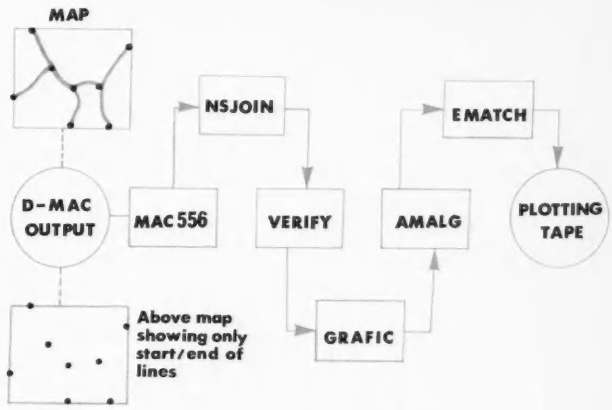

Figure 2. The basic programs used by the Experimental Cartography Unit to edit and correct digitised map data.

Software configuration

Figure 2 shows the basic programs used to edit and correct the digitised data for errors which may have been introduced at the time of digitising. The top left of the diagram shows a very crude representation of what might be a typical map. Basically a map consists of lines, which, when grouped, form closed areas with feature codes or attributes. The first program, *MAC 556*, reads the IBM-compatible tape output by the D-mac, consisting of the digital representation of the map, and converts the data to standard internal format at a density of 800 bpi. The internal format consists of mark numbers which identify the characteristics of the digitised point. The program has an optional facility for filtering line data so that no two points on any line are closer than a nominated distance.

The second program, *NSJOIN*, reads the IBM tape in standard ECU-system format as output by *MAC 556*, and prepares a corresponding output tape in which the map co-ordinates are rotated and translated so that the South West is at the origin and the South border is along the X-axis. Any distortions of the base map are corrected for by applying a transform matrix to the co-ordinate pairs. The matrix coefficients are determined by a set of equations which convert the four corner points to values specified on the national grid. The program also has the facility for merging two or more parts of the same map sheet which may have been digitised separately.

The procedure for checking and editing the digitised information is based on a principle very similar to that used in punched-card verification. Namely that the information, or certain characteristics of the information, is digitised a second

time and then compared on a one to one basis with the originally digitised file. Any discrepancies are noted and a subsequent interrogation of the map data in the region of the discrepancy is carried out. In the lower left of Figure 2, the more detailed map above is represented in an abbreviated form: ie, only the start and end points of the line segments are shown. The operator digitises these start- and end-of-line points and re-enters the feature codes of the associated lines. The output tape consisting of this file of information is then processed through *MAC 556* and *NSJOIN* and is then input into the program *VERIFY*. This program reads the abbreviated file of data into core-storage and compares it on a sequential basis with the original map data. The discrepancies or errors which can be identified by this procedure are: missing lines (which are characterised by the program's failing to match a particular start- and end-of-line point), missing attributes and incorrectly entered attributes. The program output consists of a listing of these possible sources of error.

This listing is then used to interrogate the suspect line segments via the program *GRAFIC*, which, developed by Mrs. Bell of the ECU, allows the operator to interact with the map in the on-line mode via the CRT. The interaction is carried out using a joystick device which allows the operator to point at line segments by 'steering' a tracking cross to a particular line segment and then displaying the attributes belonging to that line segment (see Figure 3). The incorrect attributes are deleted and the correct ones inserted via the teletype. Additional facilities for deleting lines and windowing on to dense regions of the map are provided by the same program. Due to the limited resolution of the CRT and the high resolution of the input data, combined with differences in scale between the CRT screen and the base map, the positional accuracy of lines has to be checked by plotting the line detail on the Geagraph and then overlaying this with the base map. Any inaccuracy in the line is corrected for by deleting the line on the CRT, redigitising it and then inserting the new line segment into the map via an updating program. When the editing is completed for a number of sheets, they are amalgamated, reduced in scale, if required, and finally compiled as a single map sheet by the program *AMALG*. Because of the different transforms applied to each sheet at the *NSJOIN* stage, which corrects for map distortion, after the amalgation is completed certain lines may not match up across the edges of the individual sheets. To correct for this, the data is passed through program *EMATCH*, which seeks out such non-matching lines and forces them to match by interpolating a straight-line segment between the end points of the lines juxtaposed on the sheet edges. The final output consists of tape which is ready for plotting on the Geagraph.

A considerable number of peripheral programs exist which allow for factors such as projection changes, anaglyph views, vector notations specifying quantities at individual points, etc., and which have not been discussed here. A detailed account of these and other programs can be found in the book *Computer Program for Mapping* by T. Lang, currently available from Architectural Press.

The ECU contouring programs

The package is in two parts. The first part accepts Z (height) values observed at an irregular scatter of locations in the X, Y plane. From these observations, Z values are interpolated at all the intersection points of a square or rectangular grid. The grid dimensions may be specified by the user. The second part accepts as an input the 'figure field grid' of Z values, and threads through it smoothly curving contours at user-specified heights. For each segment, the location of the curve between grid contour-intersection points is given by evaluation of a 'cubic quasispline' fitted through the locations at which intersections have been established.

The program, currently operational on Imperial College's CDC 6400 computer, has the capability of generating a grid with dimensions up to 201 × 201 and allows for contours at up to 50 height values. For more information, see F. Hackman, 'Scaling the Heights', *Geographical Magazine*, August 1972.

Figure 3. An ECU cartographer using a joystick device to interact with a map on the CRT display.

New software developments

Because of the large quantities of data involved in cartographic computing, magnetic tape is the current obvious storage medium. Whilst magnetic tape is a very suitable medium for handling data in a rudimentary system of processing, etc., because of the serial form of the data it is extremely difficult to carry out certain operations: eg, correlating different data sets of the same region. The medium by which this can be overcome is by holding the data on disc in some structural form and retrieving elements of the data using the random access capability. To this end, P. O'Grady, of the ECU, and the Canadian consultant, R. W. Shaw, have been studying the logic of geographical relationships so as to devise appropriate file structures for handling such data. These disc-based file structures explicitly represent relationships by using pointers between cartographic elements on a map. For example, line segments are grouped to form areas, attributes of a specific type can be chained together. The structure as it exists on disc consists of fixed-length records which contain the basic characteristics of the line segments such as start- and end-of-line points, feature codes, etc., and variable-length records which consist of all the digitised points internal to a given line segment. The two record types are linked in a logical fashion. From the editing aspect, such a disc-based system offers considerably more than a tape-based system in terms of speed and flexibility.

Ultimately, the structure will be extended to offer the more exotic capabilities of shading areas and map correlation.

Examples of current applications

Recently the Unit entered into an experiment with the Institute of Geological Sciences (IGS) to investigate the possibility of using automated methods to produce contoured bathymetric charts of large parts of the Continental Shelf forming the floor of the North Sea. Continental Shelf bathymetry is of obvious importance, given the current interest in the search for and exploitation of natural gas and oil reserves in the area. Not least in its relevance would appear to be the likely problems of pipeline construction. This summer, for the first time, an IGS survey ship will be collecting, in machine-readable form, large amounts of information on depth to the sea floor at points along the tracks steamed by the survey vessel over much of the northern United Kingdom territorial

waters in the North Sea. It is hoped that the ECU will help in the rapid and consistent processing of this kind of data into cartographic form. Another project is aimed at investigating whether automated methods of handling contoured topographic maps can assist in locating projected radar devices, to help the Meteorological Office's short-run rainfall predictions.

For the IGS field geologists we have undertaken to produce a 1-inch playback of 35 sheets of field geology of the Swindon area, digitised at 6-inch scale. In addition, we are producing similar playbacks for the Abingdon and Faringdon areas.

The Applied Geochemistry Research Unit at Imperial College have collected element concentrations in sampled river-borne material in Northern Ireland, and the ECU is employed in the machine production of layer-tinted isarithm maps displaying these analyses. The maps will form the bulk of a geochemical atlas of Northern Ireland.

These examples relate to only a few of the Unit's projects in applications, but they do indicate the extent and diversity of the data currently being handled in an automated cartographic environment.

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Computer-Aided Design of Textiles

by R. Jerrard,
Textile Research Unit, Royal College of Art

The design origination

THE initial stages of producing a textile design consist largely of the designer creating and manipulating shapes or patterns. The shapes or patterns may be drawn or printed on paper, manipulated from cut-out shapes, or produced in a variety of other ways, depending upon individual preference. Sometimes the designer may choose to work immediately in the medium for which he is designing; in which case the patterns he wishes to create are presumably held in his head or inspired by the process of weaving or knitting.

In all cases, once the initial idea has been created, the designer may wish to change a design in scale, alter particular parts of the design, place the design into some sort of 'repeat' (perhaps in response to a production-machine constraint), and, moreover, view the results of these changes as quickly as possible. If the designer is working through the medium of paint and paper, the reality of making these changes can be extremely tedious and time-consuming; so tedious, in fact, with a complex pattern, that the desired changes may not be attempted. The designer might also wish to change the colour of parts of the design in relation to other parts of the design and perhaps to create a series of colourways of the same design. It would also be an advantage to view the design in relation to previous designs.

If the designer has the opportunity of working with a computer and graphic-display system, there seems to be no restriction upon the ways in which a pattern represented on the cathode-ray tube could be changed, and, since changes of scale, symmetry operations, changes of shape, etc., can all be effected with a speed and ease impossible by any other means, the designer can be presented with an increased number of possibilities in a very short space of time. The usefulness of such a design facility would depend upon both the preference of the individual designer and the production process for which he was designing. In general, subject to commercial and technical practicability, the use of a computer and graphic-display system would make a worthwhile and sometimes unique contribution to the process of generating and manipulating pattern as part of the process of textile design. It is also considered that such a system would be a valuable aid in training textile designers.

Constraints

All textile design is concerned with the reconciliation of objectives within a given set of constraints. The constraints may be imposed by the manufacturing process, market requirements, costs and the wide variety of variables associated with materials. The designer's task is to reconcile all the various aspects of the design process with these constraints. The degree to which the designer is responsible for the reconciliation depends to some extent upon the process for which he is designing and to some extent upon his status. Sometimes the designer will be given an extremely tight and detailed design 'brief', and sometimes almost no brief at all, and to this extent it is impossible to generalise.

However, no matter how the constraints are resolved, resolved they must be. And if the reconciliation of the design objectives is carried out badly or takes place at a late stage in the manufacturing process, either the design objectives are not achieved or it may be relatively costly to attempt to achieve them. In both cases, it would be an advantage if all the constraints applicable to a particular design situation were known, preferably to the designer, at the earliest possible stage.

In one aspect of its work, the Textile Research Unit (TRU) is conducting a fundamental study of the design process and the mode of operation of textile designers. The scope of this research can be outlined as follows:

1. A detailed study of the day-to-day activities of the designer; in particular, an analysis of information requirements related to particular end products, of the relationship of acquired information to the design process, and of the form in which design information is both required and used by the designer.

2. A study of the design process; in particular, the preferred mode of operation of designers, the media used, specification of design problems, and the methods used to achieved design solutions.

3. Relating the information derived in 1 and 2 to a hypothetical CAD system. This exercise would relate existing hardware for CAD to textile-design requirements, and should indicate 'ideal' input methods, the degree of interaction required, likely software requirements, the most suitable form of output, and in general terms the allocation of functions between the designer and the computer. Finally, this computer-aided design system would be related to an existing method of manufacturing textiles—namely by weft knitting.

If a designer has access to a computer with a graphic-display system, then, in general, where the constraints of a particular manufacturing system are definable, and therefore programmable, the designer can interact with these from an early stage in the design process and thus explore alternative solutions to design problems where these conflict with a particular constraint. In theory at least, this could lead to a more satisfactory situation from the designer's point of view and to a reduction in the cost of producing a particular design.

Production processes

Printed textiles

Present-day systems of designing and producing printed textiles would, at a first examination, be very unsympathetic towards the use of CAD. Designers for printed textiles almost always work in a studio situation, have tremendous design scope, with relatively few design constraints, and usually work

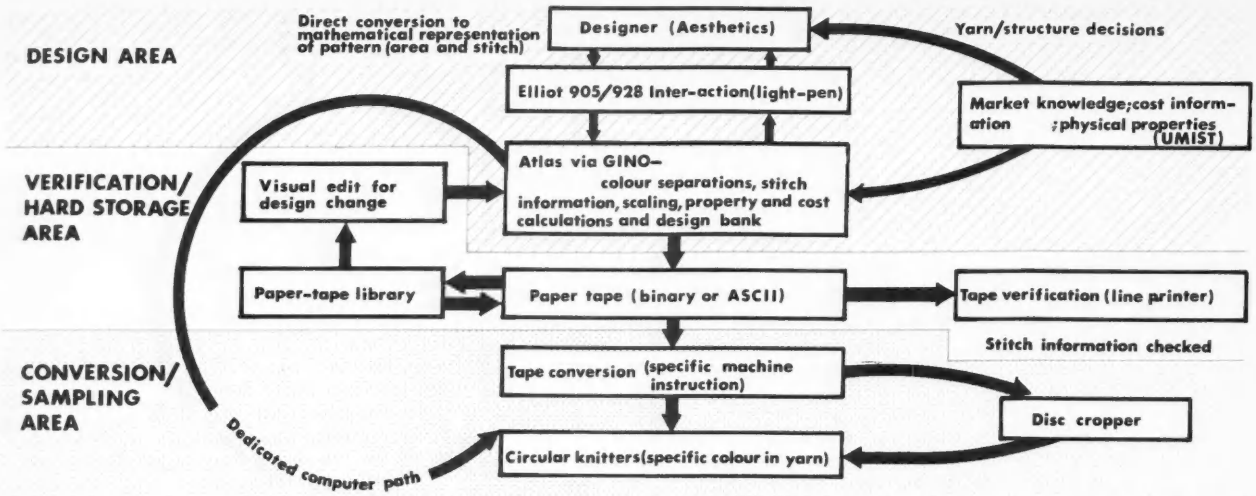
DESIGN AREA
Direct conversion to mathematical representation of pattern (area and stitch)
Designer (Aesthetics)
Yarn/structure decisions
Elliot 905/928 Inter-action(light-pen)
Market knowledge;cost information ;physical properties (UMIST)
VERIFICATION/ HARD STORAGE AREA
Visual edit for design change
Atlas via GINO– colour separations, stitch information, scaling, property and cost calculations and design bank
Paper-tape library
Paper tape (binary or ASCII)
Tape verification (line printer)
Stitch information checked
CONVERSION/ SAMPLING AREA
Tape conversion (specific machine instruction)
Disc cropper
Dedicated computer path
Circular knitters(specific colour in yarn)

Figure 1. Schematic description of a current CAD/weft-knitting project under way at the Royal College of Art's Textile Research Unit.

in almost total isolation from the production process. Designs are bought and adapted for a particular market or a particular printing process. Thus it seems that for the foreseeable future there will be an increasing conflict between market demands for printed variety, and the ability to provide this economically with present-day printing processes. This is unfortunate in that the tendency in the mass-production market for cheap textiles is towards standardization of fabric types, which can be produced on high-speed automatic or semi-automatic machines with limited ranges of yarns and fabric constructions, and which can later be given variety by dyeing, printing and finishing processes.

The application of CAD to this situation is apparently, therefore, difficult, although perhaps potentially the most rewarding in the long term, if only because of the enormous volume of printed design demanded and the increasing tendency towards standardisation in other directions. From the point of view of a designer working in the present situation in printed textiles, it would seem that the only use of CAD would be as a 'sketch-pad' facility, making use of all the possibilities outlined. It would also seem necessary to have a colour display, with both shading ability and full colour manipulation. This could have some advantages from the designer's point of view: and from the manufacturer's point of view a lot of time could be saved in unsuccessful colourway experiments on production machinery. The design information produced in this way would, however, be unusable by present printing systems unless compatible systems were developed for engraving rollers or making screens.

The full utilisation of the unique potential of CAD in printed textiles would, therefore, be possible only with new systems of printing more directly compatible with the output of design information from a computer.

Woven textiles

The designer of woven fabrics is largely concerned with manipulating yarns. Sometimes ideas may also be worked out and represented on paper, but most woven-fabric designers would emphasize the need to see an original idea in fabric form as soon as possible. The designer of a woven fabric is concerned, therefore, not solely with pattern, but with pattern, texture and structure. Therefore an interactive graphics system solely for the design of woven *pattern* may not be as useful as in other areas of textile designing. This would depend to a certain extent upon the type of fabric: a designer for jacquard woven fabric would obviously find a graphics system more useful than a designer for dobby woven fabric from the point of view of designing *pattern*.

This seems to indicate that a computer-aided design system for woven fabrics would, initially, be most useful in converting the designer's ideas quickly into fabric, through a suitable sample of production machine. The designer would thus be able to make rapid changes of weave, colour and pattern, and see the effect of these changes in fabric form. Most woven-fabric designers would rate this of great importance.

Weft knitting

The wide variety of weft-knitting machines makes it difficult to generalise about the application of CAD, and most of the following comments, therefore, will apply to continuous fabric machines for double-knit fabrics with jacquard needle selection.

One of the main differences between designing for weft knitting and designing for weaving is that of the comparatively limited range of structures possible on weft-knitting machines, and the lack of flexibility of a particular machine to produce a wide range of weights of fabric—hence the variety of machines necessary. This means that the designer for weft knitting is not so intimately concerned with the construction of the fabric as the weaving designer. The pattern aspect of design is therefore relatively more important.

Weft knitting is at present the main area of investigation for CAD at the Textile Research Unit. The investigation involves both the evaluation of existing CAD systems, particularly hardware, and the testing of some aspects of software development. Most of the practical work is being done at CAD Centre's London Sub-Centre.

The reasons for choosing weft knitting are:

1. This is the only area of textile manufacture in which there have been rapid developments in the direction of machines with electronically actuated pattern-selection systems. These machines are therefore particularly appropriate when considering the application of CAD.

2. There is an existing problem, both in designing for these machines and in processing design information for them, which CAD could help to ameliorate.

3. Considerable developments have already taken place in processing existing data by electronic means for a large range of weft-knitting machinery, but so far little attempt has been made to facilitate the *derivation* of design data for these newer methods of converting design information into machine-control instructions.

It would also be necessary, as an integral part of this work, to consider the cost implications of using CAD methods of weft knitting. This is, however, thought to be a particularly difficult aspect of the project, in that the cost of present

methods of design conversion for weft knitting are largely unknown.

For the past four years the Textile Research Unit has worked in close collaboration with the Department of Textile Technology at UMIST, on both general and specific aspects of CAD for textiles. At UMIST a large programme of work on improved computer methods of calculating the physical properties of textiles is supported by the Science Research Council.

Wider aspects

Through CAD it is already conceivable that continuous fabrication of a wide variety of composite materials will soon be possible within very precise specifications. Their range of application can be expected to extend from lightweight to semi-structural fabric far beyond the normal scope of textiles. The production of clothing, for example, is one of the most difficult manufacturing processes, dependent upon skill, and as elaborate to rationalise as the human form itself. The Textile Research Unit is already involved in the concept of one-process design and manufacture of clothing from fabric to garment, and the work has reached prototype stage. In addition related investigations are going on into non-wovens fabrication. It is likely that continuous production could also deal with individual clothing to fit a non-standard figure as well as tailored garments for standardisation.

The textile industry is one of the UK's largest industries, and is still of major importance. Recently it has been the subject of severe structural and technological change. The formation of larger groups, the integration of long sequences of the chain from fibre producer to retailer, the introduction of new materials and processes—all are having a profound effect upon what was once thought to be a 'traditional' industry. The range of choices is now enormous, and, if anything approaching the optimum solution to a particular design problem is to be achieved, the technologist and designer must develop new methods of design. Some of the problems arising from the new situation are already being solved by the more extensive use of electronic data-processing techniques. The recent International Textile Machinery Exhibition in Paris (1971) demonstrated that there have been advances within the limits of available machine technology, particularly in the direction of providing instructions for production machines, and companies are active in this field in Germany, Switzerland, Israel, USA, Japan, the UK and France.

So far, however, developments have been concerned with either speeding up or achieving more control over the processes involved in converting design information into machine-control instructions, and have excluded the designer or design process. Consequently there is a real danger that computer-aided textile-production systems with which the designer of textiles cannot effectively communicate will be—indeed are being—developed. The time is therefore particularly appropriate for research in this field.

More information: Mr. R. Jerrard or Mr. J. Foulds, Textile Research Unit, Royal College of Art, Kensington Gore, London SW7 2EU. Tel: 01-584 5020, ext 273.

news

NEL conferences and courses

NELAPT users' meeting

The National Engineering Laboratory is holding at the Cafe Royal, Regent Street, London, a one-day meeting, on October 5, 1972, for users of NELAPT (National Engineering Laboratory Automatically Programmed Tools) Part-Programs. The meeting (which is intended to give users of NELAPT an opportunity of exchanging views and experiences, with emphasis on part-programming aspects rather than on computer programs) will be in two sessions. In the morning there will be reports by NEL and ICL staff on development and maintenance activities. In the afternoon a representative of the British Ship Research Association will speak on contour burning of large plates, and a lecturer from Strathclyde University will describe the use of NELAPT in teaching NC to engineering students. The afternoon will conclude with a demonstration of conversational NELAPT, using the UNIVAC 1108 computer at NEL, and delegates will be given the opportunity of trying the system for themselves. The meeting will also be of interest to firms contemplating the introduction of part-programming. More information: The Course Organiser, Birniehill Institute, National Engineering Laboratory, East Kilbride, Glasgow G75 0QU. Tel: East Kilbride 2022 Ext 570.

Group Technology

A one-day course, designed to teach the methods of Group Technology, with particular reference to manufacture, will be held on October 18, 1972, at the Birniehill Institute, National Engineering Laboratory, East Kilbride, Glasgow.

The course, which will enable participants to assess the feasibility of applying Group Technology to their own organisation, and also to undertake its introduction, will consist of lectures, discussions and tutorial exercises covering the various steps necessary to implement Group Technology. A case study will be presented, and extensions of Group Technology principles to other areas (eg, design and drawing office, and production planning and control) will also be dealt with.

More information from the Course Organiser, as in the preceding item.

Stress analysis and design by computer

NEL is organising a two-day conference under the above title at the Birniehill Institute, East Kilbride, on October 31-November 1, 1972. Topics covered include the large digital computer and its characteristics, the general uses of computers in design, computer graphics hardware and software, interactive techniques, design information and retrieval, numerical control of machines, and stress analysis. In recent years, due to the availability of high-speed digital computers, finite-element analysis has emerged as the most powerful general method of stress /structural analysis: not surprisingly therefore the Conference will place some emphasis on the scope of this technique. The Conference is aimed at 'those who want to know something of what present-day computer-aided design is about; engineering managers facing the problem of how to design for more difficult engineering efficiently; and the engineer/designer who wants to assess for himself the use of the problem-solving power of modern computer methods in relation to his own environment'. More information from the Conference Organiser: for address see preceding items.

Harwell course on toxic wastes

THE treatment and disposal of toxic wastes will be the subject of a course of lectures by experts from Government and industry to be held from October 16 to 20, 1972, at the Harwell establishment of the United Kingdom Atomic Energy Authority. Growing public concern about hazardous wastes and their possible effects on the environment has accentuated the need for the dissemination of authoritative information on the subject. This is the reason why Harwell—which has itself done considerable research and development in the field—has arranged the course, which is aimed at all those concerned with public waste disposal, such as public-health engineers, waste-disposal contractors and chemical manufacturers. The course is being organised by Harwell's Toxic and Hazardous Materials Group.

Bodies contributing to the lecture programme include the Department of the Environment, the Ministry of Agriculture, Fisheries and Food, the Water Pollution Research Laboratory, Warren Spring Laboratory, local authorities, universities, and industry. Legislation, environmental hazards, detoxification, re-cycling and recovery, sea-dumping, and industrial-waste disposal are among the subjects covered. During the course visits will be made to the Water Pollution Research Laboratory, Warren Spring Laboratory and installations at Harwell itself. More information: Education and Training Centre, A.E.R.E., Harwell, Didcot, Berks. Tel: Abingdon 4141, Ext. 2469 or 2140.

Solvent finishing of textiles

THE Dyers and Cleaners Research Organisation is holding a Conference on Solvent Finishing for the Textile Industry on October 18-19, 1972, at the Abbey Motor Hotel, Leicester. Oriented mainly towards those using, or considering installing, rotary solvent machines, the Conference is designed to show how to get the maximum efficiency from this type of equipment. Scouring, dyeing and the application of finishes will be covered in addition to the finer points of machine operation. More information: Mr. M. J. Briggs, Dyers and Cleaners Research Organisation Limited, Forest House Laboratories, Knaresborough Road, Harrogate HG2 7LZ. Tel: 042-3 83201.

Letter to the Editor

Dear Sir,

In his interesting article entitled *Surface Coatings for Use under Radioactive Contamination or Exposure*, Mr. P. Walker compares the B.S. 4247: *Part* 1 test method for assessing decontamination properties with the AWRE test method and rightly points out that for some materials different results will be obtained.

This was well appreciated by the members of the BS Committee who drew up the test method and in fact was implicitly stated in B.S. 4247: *Part* 2 which provides further information on the test and should be read in conjunction with *Part* 1.

On page 11 of Part 2 it is stated:

The contamination and subsequent decontamination of a surface involves so many variables that a single test cannot be expected to express fully the suitability of any particular surface. The information obtained from the test should be used in conjunction with the user's experience, the conditions of usage and the results of any other relevant tests in order to obtain a satisfactory choice of materials for the surface.

The aim of the Committee in devising this test was to obtain a method applicable to materials widely used in situations where they were exposed to a general risk of radioactive contamination rather than special situations. The test was required also to be such that it could be carried out in any good 'tracer' laboratory and hence the Committee considered the use of α emitting test materials unacceptable.

It was further thought that plutonium in acidic solution was unlikely to be encountered other than in Atomic Energy Authority establishments—where in any case the facilities were available for tests of the AWRE type to be carried out on the relatively few materials concerned. Representatives of the UKAEA survey on the Committee did not disagree with this view.

The B.S. 4247: *Part* 1 test was therefore intended to be applicable to surface materials for use in the average radiochemical situation, leaving tests of the AWRE type for special circumstances. I consider that this should be stressed to place the two types of test in correct perspective.

Yours faithfully,
A. F. Sherwood,
Paint Research Association,
Waldegrave Road, Teddington,
Middlesex.

A ten-year look at our noise environment

THE Presidential address to be given to the Society of Environmental Engineers by DR. E. J. Richards, Vice-Chancellor of Loughborough University of Technology, will have the above theme. Recently the Secretary of State for the Environment asked Dr. Richards to take a 10-year look at the noise environment in the UK. Noise now turns out to be the major source of pollution in this country, and the effects of doing nothing about it are serious. The number of people disturbed by traffic noise might well grow from 4 million to 14 million, and 2 million people can be expected to be exposed to dangerous noise levels in their factories. The talk develops these themes and indicates the nature of the crucial social and technological advances which need to be achieved if we are to re-capture the acoustical environment of the 1950s.

The address will take place at Imperial College of Science and Technology on October 18, 1972, and non-members are welcomed. More information from the Society of Environmental Engineers, 68a Wigmore Street, London W1. Tel: 01-486 6844-6.

Vehicle safety regulations and quality assurance

A ONE-DAY seminar on the Influence of Vehicle Safety Regulations on Quality Assurance is being held, under the aegis of the Midland Branch of the Institute of Quality Assurance, at Chesford Grange Hotel, Kenilworth, on October 24, 1972. Papers will be presented reviewing the new US and Continental vehicle-safety regulations and their significance for the UK; quality assurance and production problems; and the cost of safety. More information: The Conference Secretary, The Institute of Quality Assurance, 146 Cromwell Road, London SW7 4EF.

Activated carbon in water treatment

ACTIVATED carbon has been employed for many years for the control of taste and odour in water supply, and there is growing interest now in its use for removal of organic substances in general from water and liquid wastes. To bring together carbon users, plant designers and research workers, with the aim of achieving a comprehensive 'state of the art' review of activated carbon and its application to water treatment, the Water Research Association is organising a Conference at the University of Reading on April 3-6, 1973. The papers presented will be by internationally recognised experts, and will cover general principles, factors affecting the performance, design and operation of plant, and user experience. The Conference will be complemented by an exhibition of equipment. More information: The Water Research Association, Medmenham, Marlow, Bucks SL7 2HD. Tel: Hambleden (Bucks) 282.

NPL Open Days literature

A LIMITED number of sets of technical handouts prepared by the National Physical Laboratory for its Open Days held earlier this year are available to those with interests in the fields covered or who were unable to attend:

Set 1: Numerical analysis; Computer applications; Mathematics; Computer technology.

Set 2: Ship hydrodynamics; Environmental engineering; Applied acoustics; Maritime science; Marine safety.

Applications, indicating which set is required, to: Press Office, Information Services, National Physical Laboratory, Teddington, Middlesex TW11 0LW.

Metallurgical chemistry

THE proceedings of the symposium on Metallurgical Chemistry, held at Brunel University and the National Physical Laboratory in July 1971, are published this month (HMSO, price £5.50). Likely to become a standard reference source, the 600-page volume contains nine review papers, 34 original papers, and a record of the discussions—in all, representing a comprehensive summary of the developments which have taken place during the last 13 years in the field of metallurgical chemistry, both from an experimental viewpoint and in relation to our basic understanding of the nature of bonding, structure and stability in metals and alloys. The Proceedings are particularly significant in that they contain the current thoughts of eminent chemical metallurgists and metal physicists on the state of alloy theory. The application of thermodynamic principles to practical problems is strongly emphasised in papers describing thermodynamic evaluation of phase boundaries and equilibrium diagrams, and in examples of industrial applications of thermodynamic methods. The important role which the computer can play in such work, and in storage of assessed data, is discussed at some length. The volume is edited by Dr. F. P. O. Kubaschewski, of NPL.

Remote sensing of earth resources

A BOOKLET giving details of organisations and individuals in the UK known to be using remote-sensing techniques for earth surveys has been published by the Department of Trade and Industry. Compiled from replies to a DTI questionnaire, the booklet is designed to serve as a source of ready reference for organisations interested in co-operating with others engaged in this field. For convenience, organisations which are involved in similar or related activities are grouped together under the most appropriate main subject heading, eg geology, agriculture, cartography, sensor technology, etc. The information given concerning each group consists of a brief description of its activity, the facilities and equipment it owns or to which it has access, a brief mention of future plans and a list of relevant publications.

Remote Sensing of Earth Resources is available (price 50p) from the Department of Trade and Industry, Technology Reports Centre, St. Mary Cray, Kent.

International Organisation of Legal Metrology (OIML)

THE following document has been circulated by OIML to member-countries for comment:

Title: Temperature tungsten ribbon lamp for the calibration of optical pyrometers.

Reference: Second Pre-draft International Recommendation.

Copies may be obtained from Standards Weights and Measures Division, Department of Trade and Industry, Abell House, John Islip Street, London SW1P 4LN.

More information: Where possible, items in *New Technology* indicate the best sources of further information. Readers are advised also to seek information on matters relating to *New Technology* from the following DTI regional offices: Edinburgh, 031-225 1822; Cardiff 62131; Newcastle upon Tyne 27575; Manchester, 061-832 9111; Leeds 38232; Nottingham 46121; Birmingham, 021-643 8221; Bristol 21071; London and South East, 01-684 9781; Eastern, 01-828 4355. In Northern Ireland, information is given by the Dept. of Industrial and Forensic Science, Belfast 21722.

Editorial Office: Department of Trade and Industry, Room 439, 1 Victoria Street, London SW1H 0ET. Tel: 01-222 7877, ext. 2620.

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